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IS 5892 (2004): Concrete transit mixers [MED 18:
Construction Plant and Machinery]



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भारतीय मानक
कंक्रीट ट्रांसिट मिश्रक — विशिष्टि
(पहला पुनरीक्षण)

Indian Standard

CONCRETE TRANSIT MIXERS — SPECIFICATION
(*First Revision*)

ICS 91.220

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Mechanical Engineering Division Council.

The transit mixer as the name implies, basically consists of a mixer mounted more commonly on a truck, but sometimes on other suitable mobile haulage unit, for uniform mixing of various ingredients of concrete or for agitation of already mixed concrete during its transit.

A transit mixer can perform the following three functions:

- a) It can mix coarse aggregates, fine aggregates, cement and water for production of concrete while it is moving or stationary.
- b) It can prevent segregation of already mixed concrete during transit by agitation, as a result of slow revolution of the drum.
- c) It can completely mix the 'shrink mixed' concrete (that is concrete partially mixed in the central batching and mixing plant) while it is moving or stationary.

This standard was first published in 1970 with the following main objectives:

- a) To guide the manufacturers and the purchasers/users by specifying working limits for capacity, general construction and other features of the equipment;
- b) To assist in efficient production by standardization of sizes; and
- c) To guide the purchasers in acquiring equipment which meet certain minimum performance requirements.

As a result of continuous developments in last three decades in the technology and features of concrete mixers, a need was felt to revise this standard. The present revision incorporates a number of modifications which are based on the feedback received from various manufacturers and users of concrete transit mixers. The major modifications are as follows:

- i) 'Transit agitators' have been excluded from the scope of this specification. The title of the standard has also been changed accordingly. This has been done keeping in mind that no such equipment are manufactured in India for exclusive use as transit agitators. As a matter of fact, practically, transit mixers are being used as transit agitators also at low speed of the mixer drum.
- ii) Criteria of nominal capacity of transit mixer for agitation (*see Note below 4.2.1*) has been modified.
- iii) Maximum drum agitation speed (*see 5.2*) has been modified from 6 rev/min to 4 rev/min.
- iv) Maximum speed limits have been prescribed for truck and mixer drum (*see Note 1 below 5.6*) for movement of the transit mixer on temporary/uneven roads and on good roads.
- v) Maximum time limit (*see Note 2 below 5.6*) has been specified for retaining concrete in the transit mixer. Maximum limit of 250 drum rotations specified earlier has been withdrawn.
- vi) Mixer drum (*see 7.2*) is specified to be fabricated from abrasion resistant steel plates only. Alternative construction of mild steel drum with renewable liner plates specified earlier has been withdrawn.
- vii) Mechanical systems for drive to the mixer drum by V-belt or by reduction gear (that is ring gear and pinion arrangement) or by chain and sprocket as specified earlier have been withdrawn.
- viii) Power take-off for mixer drive from front-end (crankshaft) and rear-end (camshaft) of the vehicle chassis as specified earlier have been withdrawn.
- ix) 'Revolution counters' and 'drum speed indicators' (*see 7.4*) have been made optional items. These were compulsory items in the earlier edition.
- x) Minimum capacity of mix water tank (*see 9.1.2*) has been increased from 150 litres/m³ to 200 litres/m³.

(Continued on third cover)

Indian Standard

CONCRETE TRANSIT MIXERS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard covers inclined axis, rotary drum type concrete transit mixers, driven by power take-off from the mobile vehicle's engine itself or through a separate engine for mixing and/or agitation of concrete during transit. Agitation, mixing and discharge of concrete is obtained by the screwing and lifting effect of the double internal drum spirals during drum rotation.

1.2 The standard defines the various terms, designations and standard sizes of the transit mixers. It also specifies the requirements of construction, capacity, performance, accessories and various other features of transit mixers.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
2932 : 1993	Enamel, synthetic, exterior: a) undercoating, b) finishing — Specification (<i>second revision</i>)
4634 : 1991	Methods for testing performance of batch-type concrete mixers (<i>first revision</i>)
4926 : 1976	Specification for ready mixed concrete (<i>first revision</i>)
7372 : 1995	Lead-acid storage batteries for motor vehicles — Specification (<i>first revision</i>)
10262 : 1982	Recommended guidelines for concrete mix design

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Transit Mixer — A mixer generally mounted on a truck or some other suitable mobile haulage unit, capable of mixing ingredients of concrete and/or for

agitation of already mixed/partially mixed concrete during transit from a concrete batching plant to the point of placement of concrete.

3.2 Gross Drum Volume — This is the total interior volume of the revolving portion of the mixer drum.

3.3 Nominal Batch Capacity of Mixer — The volume in cubic metres of mixed concrete (of 80 mm slump and aggregates of 40 mm maximum size) which may be held and mixed properly, without spillage, in one batch in the mixer drum.

NOTE — Carrying capacity of the transit mixer will reduce with concretes of higher slump and/or the uphill road gradient.

4 DESIGNATION OF SIZES

4.1 The sizes of concrete transit mixers shall be designated by the number representing the nominal batch capacity of its mixer drum in cubic metres together with the suffix TM.

4.2 The concrete transit mixers shall be of the sizes given in Table 1.

Table 1 Sizes of Transit Mixers

Designation	Nominal		Capacity
	For Mixing m ³		For Agitation m ³
(1)	(2)		(3)
3TM	3		3.75
4TM	4		5.00
5TM	5		6.25
6TM	6		7.50
7TM	7		8.75
8TM	8		10.00

4.2.1 Intermediate and other sizes shall not be considered as standard sizes; however these may be supplied by mutual agreement between the purchaser and the supplier.

NOTE — The nominal capacities for agitation given in Table 1 will apply when concrete is 'shrink mixed' (that is partially mixed) in a central batching and mixing plant with part quantity of water to keep its slump low during transportation by transit mixer. The remaining mixing is done after addition of balance quantity of water in the transit mixer at site, when it is stationary.

5 OPERATIONAL SPEEDS

5.1 The manufacturer shall provide all necessary equipment and accessories for minimum speed range of 0-14 rev/min of the drum in both directions.

5.2 Agitation Speed — Agitation speed shall not be less than 2 rev/min of mixer drum. However, for concretes of lower slumps, the agitation speed can be more, subject to the maximum limit of 4 rev/min.

5.3 Mixing Speed — Mixing speed of the drum shall not be less than 4 rev/min. It will generally be in the range of 4 to 6 rev/min if partially mixed concrete is received from batching and mixing plant and final mixing is done in the transit mixer during its transit.

The mixer drum may be rotated at higher speed for 2-3 minutes while the truck is stationary for uniform mixing of partially mixed concrete, if travel time of the transit mixer is short or if dry-mix ingredients of concrete are loaded in the transit mixer from the batching plant for mixing of concrete in the transit mixer. But in any case, maximum speed of the loaded drum shall neither be more than 16 rev/min nor more than a speed resulting in the drum peripheral velocity of 70 m/min at its largest diameter.

5.4 The number of revolutions of the mixing drum (after addition of water in the ingredients of dry-mix into the drum) for uniform mixing of concrete shall be between 70 to 100 revolutions. Beyond these mixing revolutions, agitating speed of the drum shall be between 2 to 4 rev/min.

5.5 The mixer drum shall be rotated at a speed of 12-14 rev/min for a few seconds for thorough mixing of concrete before its discharge from the transit mixer. However, this speed shall be limited to the speed resulting in the drum peripheral velocity of 70 m/min at its largest diameter.

5.6 Speed of mixer drum may be increased up to 12 rev/min for achieving higher rate of filling or discharge. However, this speed shall be limited to the speed resulting in the drum peripheral velocity of 70 m/min at its largest diameter.

NOTES

1 The operator/field supervisor shall ensure that the drum of transit mixer rotates only at minimum permissible speed to reduce its wear. During movement of the transit mixer on temporary/uneven roads, the speed of drum shall not exceed 4 rev/min and speed of the truck shall not exceed 20 km per hour to avoid accidents due to overturning. However, drum speed may be increased to 6 rev/min and truck speed may go up to 40 km per hour, if condition of road is good.

2 Concrete must be unloaded from the transit mixer within the following time limits (*see* 6.3.1 of IS 4926) after its receipt from batching and mixing plant or after addition of water to the dry mix ingredients of concrete in the transit mixer:

a) Within 1½ hour when atmospheric temperature is above 20°C.

b) Within 2 hours when the atmospheric temperature is at/below 20°C.

3 The drum of transit mixer shall be completely dry and the aggregates shall be in Saturated Surface Dry (SSD) condition (*see* Note under 3.3.4 of IS 10262) when dry-mix ingredients are received from batching plant and mixing of concrete is done in the drum of transit mixer itself.

6 GENERAL CONSTRUCTION

6.1 Besides the vehicle chassis, mixer drum and mixer drive mechanism, other main components of transit mixer are the frame structure (for mounting of mixer assembly and accessories), water system, charging hopper, discharge chute, controls, etc. All transit mixers of the same size, manufactured or supplied under a specific contract shall be physically and mechanically identical. The unit shall be designed on the basis of a single-man control for mixing or agitation and truck operation.

6.2 The complete assembly of transit mixer shall be supplied with 2 coats (each of 30 microns thick) of anti-corrosive primer and 2 coats (each of 30 microns thick) of synthetic enamel paint or PVC paint. The components shall be thoroughly cleaned for removal of rust, oil, grease, dust, etc, before application of primer coat. Painting of mixer drum shall be in stripes of two different colour shades. Colour shades of stripes will be as per mutual agreement between the supplier and the purchaser. Synthetic enamel paints shall conform to IS 2932.

7 MIXER UNIT

7.1 Various components of the mixer unit shall conform to the requirements as given in 7.2 to 7.3.

7.2 Mixer Drum — The rotary mixing drum shall be made of high tensile strength, high manganese steel or equally abrasion-resistant steel plates of adequate thicknesses. Two numbers spiral shaped mixing and auxiliary blades in the form of continuous spirals of progressively increasing height shall be welded along full length inside the drum. The direction of helix of these blades shall be opposite to each other. A continuous flat (minimum size 25 mm × 4 mm) shall be welded on the outer edge of spiral to make the blade T-shaped for its stiffening and for extra protection against wear. These blades shall also be of high tensile strength, high manganese steel or equally abrasion resistant steel plates not less than 3 mm thick. The mixing blades shall carry hard faced bead weld on leading edges for maximum life and for ease of built-up on wearing. The blade formation and size shall be such, so as to mix concrete of uniform consistency (*see* 18) in the shortest time and to enable quick as

well as uniform discharge from the drum, when it is reversed.

7.2.1 Minimum Drum Volume

The gross drum volume shall not be less than 1.7 times of nominal mixer capacity.

7.2.2 Drum Opening

The drum opening shall not be less than 900 mm diameter and shall be provided with drip ring for its stiffening and to prevent grout running down the mixer drum.

7.2.3 Drum Rollers

The drum shall be mounted on two sets of twin rollers of at least 150 mm dia with suitable cover for protection against dust/dirt. The rollers shall be of cast steel or forged steel and shall be surface-hardened, precision ground and fitted with anti-friction bearings.

7.2.4 The drum roller track shall be made as one piece from wear resistant high carbon or equivalent alloy steel bar or alloy steel casting. It shall be welded or shrunk to the drum and subsequently machined properly so as to ensure smooth and true running of the drum.

7.2.5 Closed end of the mixer drum shall be bolted to the flange of planetary gearbox. Design of planetary gearbox shall be such that the driving mechanism is not put to undue stresses or jerks due to minor drum movement while driving over uneven ground.

7.3 Mixer Drive — The drive to the mixer drum shall be hydrostatic type which shall be either through power take-off unit from the vehicle engine itself or through a separate diesel engine, as per specific agreement between the purchaser and the supplier. In both cases, the mixer drum shall be rotated by an oil bath type low speed planetary gearbox, powered by high torque reversible type hydraulic motor through variable displacement hydraulic pump. The hydraulic system shall be a close loop circuit with micro filtration arrangement. The hydraulic circuit will have a strainer in the hydraulic tank and at least 10 micron filter in the suction line. A separate oil cooler with thermostat shall be provided for controlling the temperature of hydraulic oil. Hydraulic system shall be of proven performance in transit mixer operation.

7.3.1 In the case of power take-off type units, the vehicle chassis shall be furnished with flywheel end (gearbox) power take-off. The vehicle shall be of adequate horsepower rating so as to be able to supply required power for the mixer drive under all operating conditions (during transit as well as in stationary condition) without affecting its own normal performance as a truck.

7.3.2 Alternatively, drive to the mixer drum may be provided through a separate self-start type diesel engine mounted suitably on the vehicle chassis between the driver cab and the mixer drum. This engine shall form an integral power unit of the assembly. A separate instrument panel shall be provided which shall be located near the diesel engine in such a way so as to be easily accessible to the operator while standing at ground level. The instrument panel shall contain engine oil pressure gauge, fuel gauge, engine tachometer (rpm meter), ammeter, temperature gauge (water temperature gauge for water-cooled engine or engine oil temperature gauge for air-cooled engine), ignition switch (starting switch), engine stop switch/arrangement. It will also have glow lamps to indicate low engine oil pressure and failure of battery charging system. Air-cooled diesel engines shall be equipped with glow lamp or audible warning device to indicate fan-belt failure.

The following arrangements will be subject to specific agreement between the purchaser and the supplier:

- a) Diesel engine to be water-cooled type or air-cooled type;
- b) Separate fuel tank for mixer engine or fuel supply to be taken from the fuel tank of truck; and
- c) Separate battery (IS 7372) for mixer engine or electric supply to be taken from the battery of truck. For first option (that is, separate battery for mixer engine), the standard supply will include alternator and battery charging system. For this option, a metallic cover shall be provided for protection of battery.

7.4 Revolution and Speed Recording — For indication of revolutions and speed of the mixing drum, the transit mixer shall be provided with revolution counter and drum speed indicator as given in 7.4.1, 7.4.2 and 7.4.3. However, provision of these items is optional and these shall be provided only if specifically agreed by the supplier and the purchaser.

7.4.1 Revolution Counter

‘Revolution Counter’ shall be electrically operated, limit switch type or an acceptable mechanical type, which shall be capable of being reset for each batch. This device shall be provided for recording total drum revolutions during mixing/agitation of any particular batch.

7.4.2 Drum Speed Indicator

‘Drum speed indicator’ shall be an electrical or mechanical type tachometer to indicate revolutions per minute of the mixer drum.

7.4.3 Readings of ‘Revolution Counter’ as well as

'Drum Speed Indicator' shall be recorded on dashboard of the haulage vehicle. These devices shall be positioned on the dashboard in such a manner that they are clearly visible to the operator and shall be within his reach for resetting.

8 FRAME AND MOUNTING FOR MIXER

8.1 The supporting frame for the mixer and its components shall be designed for proper load distribution on the chassis of haulage vehicle and shall be of sturdy construction.

8.2 The supporting frame of the mixer unit shall have pre-drilled holes for its mounting on the truck chassis by 'U' bolts. The frame structure shall be complete with rubber pads, 'U' bolts, clamping pulleys and all necessary hardwares for mounting of the mixer assembly on truck chassis.

NOTE — The mixer assembly shall be positioned on the truck chassis at such a location so that center of gravity of the fully loaded mixer falls between front and rear axle of the chassis and it is closer towards the front axle.

9 WATER TANK AND WATER SYSTEM

9.1 The transit mixer shall be furnished with a water tank as described in **9.1.1** or **9.1.2** based on specific agreement between the purchaser and the supplier/manufacturer. The inside surface of water tank shall be given treatment for protection against corrosion and rust.

9.1.1 Flush Water Tank

Where only flush water tank is furnished, the capacity of the tank shall be minimum 200 litres. The tank shall be equipped with a glass sight gauge on which the markings shall be clearly visible for the entire range. The sight gauge shall be of sturdy construction and shall be protected against damage.

9.1.2 Mix and Flush Water Tank

This shall be a single compartment tank (for mix water only) or a two-compartment tank for mix and flush water. Total capacity of the tank may not be more than 250 l/m³ of nominal mixer drum capacity. Capacity of the flush water compartment shall be minimum 200 litres. Capacity of the mix water compartment shall not be less than 200 l/m³ of the nominal mixer drum capacity, if dry mix is received from the 'Batching Plant' and mixing of concrete is done in the transit mixer itself. However, capacity of the mix water compartment may be reduced if the transit mixer is to be used only for agitation of concrete or for final mixing of shrink-mixed concrete. In such cases, the capacity of mix water compartment will be as per specific agreement between the purchaser and the supplier. The tank shall be equipped with glass sight

gauges on both the compartments on which the gauge markings shall be clearly visible through the entire range. The sight gauges shall be of sturdy construction and shall be protected against damage.

The system shall be equipped with necessary plumbing to provide for checking of the calibrations. The mix water compartment shall be equipped with an automatic water measuring device as described in **9.2**.

NOTE — Water for the entire batch, when taken only from the truck mixer water system, shall be introduced into the batch at the head section of the drum or by dual injection into the head and discharge section of the drum to ensure rapid and complete dispersal of water throughout the entire batch.

9.1.3 A water pump or pressurized tank system using air pressure of the haulage vehicle or any other suitable method for delivering water under pressure from the Flush Water Tank/Mix Water Tank shall be furnished which shall be capable of delivering not less than 160 litres of water per minute into the drum. The water tank shall be provided with a pressure gauge if pressurized tank system is used. A properly supported wash hose with washing nozzle and a hand valve operated from ground level shall be included in the system.

9.2 Water Measurement Devices — Accurate means shall be provided for measuring the quantity of water flow from mix water tank to the mixer drum. Water measuring devices may be any of the following types:

- a) Automatic cut-off syphon type, and
- b) Water meter of automatic shut-off type.

NOTE — The above provision of water measurement device is only with mix water tank in accordance with **9.1.2**.

9.2.1 The quantity of water delivered to the mixer drum from mix water tank shall not vary from the predetermined quantity by more than ± 1 percent of the indicated quantity.

10 CHARGING HOPPER

10.1 The charging hopper at open-end of the transit mixer shall be stationary type, properly supported in concentric position with the drum opening. The hopper dimensions shall be adequate so as to pass down all the materials into the drum, without spillage, under normal working conditions at a minimum rate of 4 m³ per minute. The charging hopper shall be made of abrasion resistant steel. Alternatively, it shall be fabricated from mild steel plates with renewable abrasive liners.

10.2 Where the purchaser so desires, a drum closure plate arrangement shall be provided to prevent spillage as encountered on hilly terrain, especially in the case of concrete of higher slump. However, this is subject to a specific agreement between the purchaser and the supplier/manufacturer.

11 DISCHARGE CHUTE

The discharge chute shall consist of a fixed U-chute and a set of foldable distributing chute. These chutes shall be made of abrasion resistant steel or fabricated from mild steel plates with renewable abrasive liners.

The distributing chute shall be of swing away type with fold-over extensions. The swing out fixture shall prevent the need to remove or replace the chute for direct discharge into high forms, hoppers or buckets. The chute alignment shall be such that the center line of the chute plate is at an angle not less than 40° to the horizontal when it is in discharge position. Means shall be provided for locking the distributing chute components in position when the mixer is in transit. The distributing chute shall be equipped with ratchet type or mechanical screw jack type or hydraulic chute lift for its quicker positioning.

All attachments shall be on the outside of the chute to ensure smooth flow of concrete.

12 CONTROLS

The controls for drum speed in either direction of rotation for its charging and discharge shall be fitted at the rear side of the mixer unit within the reach of the operator (*see* 'Note' below). The controls shall be mechanically or hydraulically operated and they shall be of sturdy design and easy to operate. All controls shall be properly labelled indicating their functions and the manner in which they are to be operated.

NOTE — If specifically agreed by the purchaser and the supplier/manufacturer, the controls for drum speed for its charge and discharge may be fitted in duplicate, that is, at the rear side of the mixer unit as well as in the cabin of the haulage vehicle.

13 OTHER ACCESSORIES

13.1 Inspection Hatch — The mixer drum shall be provided with 2 Nos. hatches/manholes not less than 500 cm in diameter in the periphery of the drum to permit easy access to inside surface of the drum for inspection, cleaning, repair, welding and building up of worn-out spots of the drum and the blades. Hatch covers shall be of quick-detachable type and shall have sealing arrangements to prevent leakage. The position of hatches shall be such that one of them can serve as emergency discharge opening to prevent concrete from setting inside the mixer drum in case of failure of drum drive.

13.2 Lifting Attachments — The mixer shall be provided with eyehooks or other suitable means for its lifting in normal position for assembly or dismantling. The attachments shall be so located that when hoisted,

adequate clearance exists between lifting slings and all exterior parts of the equipment.

13.3 Access Ladder and Safety Guards — A folding type access ladder from ground level to the charging hopper with a non-skid platform and hand railings shall be provided for inspection of the charging hopper and U-chute of the transit mixer. Safety guards shall be provided for all hazardous moving parts. Wire mesh guard shall also be provided near the fixed segment of U-chute to ensure safety of the operator during its inspection.

13.4 Miscellaneous Optional Accessories — Based on requirements of the purchaser, the transit mixer may be equipped with the following accessories. However, provision of these accessories shall be subject to a specific agreement between the purchaser and the supplier/manufacturer.

13.4.1 Hour Meter

To record total running time (in hours) of drive unit of the mixer drum.

13.4.2 Sun Protection of Drum

Hessian cloth jacketing of mixer drum for protection against high outdoor temperature.

13.4.3 Thermodrum

Drum insulation by 15 to 20 mm thick insulation material and galvanized iron sheet outer jacket for protection against very high or very low outdoor temperature.

13.4.4 Concrete Additive Tank

It may be fixed near the charging hopper for addition of additives in concrete by gravity. Alternatively, it may be mounted at the mudguard level for pressurized discharge of additives, with air pressure of the haulage vehicle.

14 LUBRICATION

Lubrication fittings shall be provided for all moving parts. Such fittings shall be easily accessible and shall conform to the relevant Indian Standards.

15 TOOLS AND OPERATING INSTRUMENTS

A strong tool box with lock and key containing necessary tools for normal operation/maintenance shall be provided with each machine. An inventory of the tools, operation and maintenance instructions and a spare parts list shall also be provided with each machine.

16 COMPLIANCE WITH ROAD TRAFFIC ACTS

The truck type transit mixer shall comply with relevant provisions of Road Traffic Act and Motor Vehicle Act.

17 MARKING

17.1 Instruction Plates — The transit mixer shall be fitted with suitably located instruction plates pertaining to warnings and cautions describing any special or important procedures to be followed in operation and maintenance of the transit mixer.

17.2 Name Plate — Each transit mixer shall have a rating plate fixed to a conspicuous part of the equipment which is not easily removable. The following information shall be clearly marked on the rating plate:

- a) Manufacturer’s name,
- b) Transit mixer SI No.,
- c) Nominal capacity in cubic metres for mixing,
- d) Year of manufacture, and
- e) Total weight of mixer unit.

18 MIXING EFFICIENCY

18.1 The transit mixer shall be tested under normal working conditions in accordance with the method specified in IS 4634 with a view to check its ability to mix the ingredients to obtain a concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (weight in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.

18.2 The percentage variation between the quantities of cement, fine aggregates and coarse aggregates (as found by weighing in water) in the two halves of a batch and the average of the two halves of the batch shall not be more than the following limits:

Cement	8 percent
Fine aggregates	6 percent
Coarse aggregates	5 percent

(Continued from second cover)

- xi) Measurement of water flow (*see 9.2*) by sight gauge, being highly inaccurate, has been withdrawn from the recommended types of water measurement devices.
- xii) Allowable tolerance (*see 9.2.1*) of water measurement devices has been modified from ± 3 percent to ± 1 percent.
- xiii) 'Charging hopper' and 'discharge chute' (*see 10.1 and 11*) have been specified to be fabricated from abrasion resistant steel plates or from mild steel plates with renewable abrasive liners.
- xiv) Provision of miscellaneous items like 'hour meter', 'sun protection of drum', 'thermo-drum' and 'concrete additive tank' have been made (*see 13.4*), as optional items.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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